Thesis/
Reports
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Fire Climatology Development

SYSTEMS FOR ENVIRONMENTAL MANAGEMENT

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2108
PROJECT FILE

FIRE CLIMATOLOGY DEVELOPMENT

Supplement 7 to Master

Memorandum

Final Report

Larry S. Bradshaw

Principal Investigator

15 December 1981

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Introduction

This brief report documents the results of the a fire climatology development project which was a cooperative effort between the USDA Forest Service, Intermountain Forest and Range Experiment Station, Northern Forest Fire Laboratory, and Systems for Environmental Management. The project had four objectives:

1. Develop a user-oriented fire climatology software package and install it at the USDA Fort Collins Computer Center,

2. Demonstrate the utility of the computer package by producing a handbook summarizing all the AFFIRMS weather data in a Forest Service Region,

3. Evaluate the utility and associated cost of including year-round weather data from selected reference point stations on the AFFIRMS database, and

4. Characterize the climate during severe fire seasons in the Northern Rocky Mountains.

The fourth objective has not been completed during this project and has been transferred to a new cooperative aid agreement between the same parties with a completion date of 31 December 1982.

The other three objectives have been met and are discussed briefly here. The final report has three distinct, independent components; one for each objective. Each component is submitted as a seperate section in this package.

Objective 1: A Climatology Software package, consisting of eight computer programs has been developed and installed at the Fort Collins Computer Center. There are five basic climatology programs for summarizing data from the National Fire Weather Data Library. Parameters that may be tabulated are temperature and humdity data (observation time, daily maximum, minimumns, and means); precipitation (two programs); wind speed and direction; and the frequency of co-occurrence of selected class values of observation time temperature, relative humidity, and wind speed.

The programs have been operational at FCCC for two years and have had extensive testing by myself and Arnold Finklin. Mr. Finklin found every quirk that the programs had and made numerous helpful suggestions for data integrity and output formats. The

programs were introduced to potential users at the Intermountain Fire Council Meeting in Salt Lake City, in October of this year.

The other three programs in the package are adjustment or averaging programs that incorporate techniques described by Mr. Finklin to compensate for biasis in the fire-weather library caused by short and incomplete data sets for many of the stations in the the library. There are two programs to adjust temperature and relative humidity data, and one for precipitation. They all require data summaries from nearby stations with more complete records to compute ratios and differences for use in adjusting the biased climatic summaries. These three programs are in the climatology package at FCCC and there is also a copy of them on the mini computer here at the Northern Forest Fire Laboratory.

A user's manual for the programs has been written and revised and is included in section two of this package. The user's manual and associated programs satisfy section II, paragraphs D, E, F, H, and I of the cooperative aid agreement. Also included seperate from this report is compiled listing of each of the programs in the software package. The programs are well documented with comments. Program variables and input formats are defined, and job control language needed for program execution is given.

Objective 2: Included as a section of this report is a climatic handbook containing climatic summaries and associated costs for AFFIRMS stations in region 1, plus year-round summaries from the Missoula Airport. Data from the Missoual airport was obtained from the National Climatic Center and converted to fire-weather formatted (and observationally equivilent) record through a series of computer programs developed in objective 3 of this study. The handbook demonstrates the utility of the climatology software package and demonstrates the capabilities of all of the program. Due to the bulk of the output, for demonstration purposes data from each station in the Nothern Region was not anlalyzed. Instead, three sets of data were summarized:

1. Twenty fire-weather stations on the Lolo National Forest,
2. Eight stations throughout the Northern Region that are considered key, or primary stations for rating fire danger in the operational actvities Aviation and Fire Management, and
3. Missoula County Airport data.

The actual summaries are tabulated on computer printout and are external to this report, but a summary is included in section three. Together, these satisfy section II, paragraph G of the cooperative aid agreement.

Objective 3: Year-round data in the AFFIRMS fire-weather database is a rarity, but often desirable. The main source of year-round data is from Airways Surface Obsevations taken at principal airports throughout the United States. These observations are available from the National Climatic Center in Asheville, North Carolina. The observations are on magnetic tapes which must be purchased. There are eight observations per day, with data generally beginning in 1948 with 365 days of record per year. To convert the data to a format compatible with the National Fire Weather Library, an additional data tape must be purchased which contains daily summary data of maximum and minimum temperature and precipitation amount. Three computer programs have been written to convert these data to fire weather formatted records. The cost and utility of this information is discussed in section four of this report and satisfies section II, paragraph C of the cooperative aid agreement.

A file of year-round fire-weather formatted weather records from the Missoula Airport has been put on FCCC mass storage and were used in the demonstration of the climatology package.

So, if your´re really excited now, just wait until you read on.....

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Fire Climatology Development

Objective 3: Evaluate the utility and associated cost of including year-round weather data for selected reference point stations in the AFFIRMS data base.

SUMMARY

Due to administrative fire-weather data collection policies and the cost of operating weather stations, very little weather data exists for periods before or after primary fire seasons throughout the country. This eliminates using the National Fire Weather Data Library (Furman and Brink, 1975) for multiple-use management planning activities where mountain and range climatological data are needed during seasons with low fire-danger--up to three-fourths of the year. In particular, fire management officers cannot accurately estimate the frequency of favorable prescribed burning conditions outside the main fire season, nor can new fire-management and fire-economics planning systems incorporate pre- or post-fire season climatologies into their analysis.

This data shortage can only truely be alleviated by having the actual fire-weather stations stay open longer each year, and have standard opening and closing dates--dates not dependent on each years weather. A partial solution to this problem has already begun with the installation of automatic remote meteorlogical stations in the western states. These stations are programmed for hourly observations of temperature, wind speed and

irection, humidity, and precipitation. The stations are solar powered and transmit observations every three hours to a geostationary earth satellite (GOES) which then relays the data to an earth recieving station. Currently it can be routed to the Bureau of Land Management's (BLM) receiving station at the Boise Interagency Fire Center (BIFC), or the National Environmental Satellite Service's (NESS) receiving station at Wollops Island, Viginia. Selected observations could then be added to the fire-weather library at Fort Collins. This would create both a year-round data base (if desired) and also generate the capability of having more that one observation per day in the data base--a feature even more restricting that the lack of year-round data.

Unfortunatly, the data only now only get as far as the receiving stations and then to specific users (organizations) through previously arranged channels. The data do not go into the fire-weather library, although the data are collected specifically for fire-weather and fire-danger purposes. Incidently, BLM remote stations are also hooked into their western lightning detection system combining for complete, essentially real-time, lightning and weather monitoring of most of the western United States. It should be stressed that this program is in it's infant stage and will take a good deal of time to generate the database needed for a good climatology (if they start archiving the observations in a systematic manner).

The other alternative is to use climatological data currently available from the National Climatic Center (NCC) is Asheville, North Carolina. Data are required on a year-round basis and must be complete enough to reconstruct an observation that is equivalent (in format and content) to those in the fire-weather library so that one system can use both databases. The only data with these attributes are the Airways Surface Observations (ASO's) taken at major airports and Federal Aviation Administration (FAA) reporting stations. In the Northern Region of the U.S.D.A. Forest Service, this amounts to the following ten stations:

1. Kalispell, Montana
2. Missoula, Montana
3. Great Falls, Montana
4. Helena, Montana
5. Billings, Montana
6. Havre, Montana
7. Butte, Montana
8. Lewiston, Montana
9. Miles City, Montana, and
10. Lewistown, Idaho

In addition to the ASO's, seperate tapes of daily summary data are needed to complete the reconstuction of a fire-weather observation.

These records can then be processed through standard

FIREFAMILY (Main et al.,1981) programs, and the climatology and averaging programs described in the Climatology User's Guide. For this project, data tapes were purchased from NCC for the above stations at a total cost of $1740.00 and three computer programs written to reconstruct fire-weather records from them (see figure 1). Shepard and Grenmmer (1980) published programs to do the same thing, but they used data in an 80 column card format, not the standard tape format provided by NCC. The programs reside at the U.S.D.A. Forest Service, Intermountain Forest and Range Experiment Station, Northern Forest Fire Laboratory's computer center. The tapes are currently stored at the National headquarters of Systems for Environmental Management, in Missoula, Montana. Data from the Missoula airport were used to create a sample data set at the Fort Collins Computer Center. The file is named:

R1FIRE*MSLAWX

and was used as a long-term station representative of the Lolo National Forest in the demonstration handbook included in this final report.

The data file has been archived at FCCC and is available for other uses. Dave Bunell on the Lolo National Forest used the database for planning logging sales and estimating opening and closing dates of logging operations. The Fire Economic Research

Work Unit 2111 at the Riverside Forest Fire Laboratory (PSW Forest and Experiment Station) are also using the data file in their Fire Economics Evaluations System (FEES) to look at a longer season of climatological data, and have also used the programs to generate a data file of Missoula airport weather in a fire-weather record format of four observations per day to simulate historical diurnal fire-weather and fire-behavior patterns for their FEES model.

The following pages document data from the NCC needed to reconstruct fire-weather observations and programs needed for the process.

National Climatic Center Data

Contact may be made with NCC by writing:

National Climatic Center
Federal Building
Asheville, NC 28801

Telephone: FTS 672-0683/0203

Two data sets are needed, first the ASO's on TD-1440, and the daily summaries on TD-9727 (card deck 486). Tapes are 9-track, 1600 bpi. The TD-1440 tapes are built with a blocking factor of four and each record is 495 characters long with six hourly observations per record. Data are generally available from 1948 to the current year. The TD-9727 tapes are built with blocking factors of 25 and each 80-character record contains summary data for one day.

TD-1440 tapes generally cost from $70 to $100 per station and there is one station per tape. TD-9727 tape cost about $15 to $25 per station (depending on the number of records) and all requested stations are on one tape. Three programs operate on the tapes to

create the fire-weather library formatted record.

Program SURFOB reads the ASO tape and gets the fire-weather observation time (or you may specify other times) temperature, relative humidity, wind speed, wind direction, and state of the weather for each day within user specified data inclusion dates. It builds a temporary file of these parameters for use in program SUMERG.

Program SUMERG takes the daily summary data (maximum and minimum temperature and precipitation amount), matches the date with dates from the SURFOB file and writes a final fire-weather formatted record for each day.

Program SELECT was written to take the summary data from one or more stations off of the TD-9727 tape and create a disk file for use by program SUMERG. This is only useful when there are many stations on the TD-9727 tape.

Both tapes are written in EBCDIC and must be converted to ASCII before they may be used by the conversion programs on the mini-computer. There is a conversion program on the mini that will do this and is discussed in the program SURFOB user's guide.

References

Furman, R. William and Glen E. Brink

The national fire weather library: what it is and how to use it. US Department of Agriculture, Rocky Mountain Forest and Experiment Station, Fort Collins, Co., General Technical Report RM-19, 8 p., 1975.

Main, William A., Robert J. Straub, and Donna M. Paananen.

A user's guide to firefamily: a computer program for fire planning with historic weather data. U.S. Department of Agriculture, North Central Station, General Technical Report, NC-81, 1981.

Shepard, John H, and Thomas V. Gemmer

Fire weather data for the national fire danger rating system. Fire Management Notes--Winter, 1979-1980, p 7.

Program SURFOB

Programmed: Larry S. Bradshaw
Systems for Environmental Management
P.O. Box 3776
Missoula, Montana 59806

Language: ASCII/ANSI 1977 FORTRAN

Machine: PERKIN-ELMER 3220 Mini-computer
Northern Forest Fire Laboratory
Missoula, Montana

Usage: Interactive or Batch

Function: Reads NCC surface observations from NFFL disk file and creates partial fire-weather formatted for merging with daily summary information by program SUMERG.

Introduction

Program SURFOB has been written in conjuction with programs SELECT and SUMERG to create fire-weather formatted records compatible with those from the National Fire Weather Data Library. It uses the hourly airport surface observations (ASO's) from the National Climatic Center which are available on 9-track, 1600 bpi. Tapes are furnished with a blocking factor of 4 and each recored is 495 characters in length. The tapes are written in EBCDIC.

The PERKIN-ELMER mini-computer at the NFFL uses ASCII code but has a tape conversion program that will convert from EBCDIC to ASCII. A special version of the program has been written to allow the 495 character record conversion. The process is to take EBCIDE tape and convert it to an ASCII disk file and then write the file back on the tape in ASCII. The tape can then be copied directly to the disk for further processing. To invoke the conversion program, first have the operator mount the tape and type

EBCDIC

the computer will then repond with

```
*************************
CODE CONVERSION PROGRAM
FOR 495 CHARACTER TAPE
EBCDIC, ASCII, OR EBCDIC 026
*************************
```

it then prompts the user for an output file name to write the records to.
The user responds with

TEMP.DAT

It then asks for the tape blocking factor which is entered as

4 (use 25 for TD-9727)

It then asks if the input file is to be rewound, you respond

NO

It gives you a menu of conversion options. Type

ASCII

The program then begins execution and translates the EBCDIC tape to an ASCII disk file. When the program terminates, then copy the ASCII file back to the tape via the following sequence.

```
COPY
OUTPUT MAG1:,495/4      (use OUTPUT MAG1:,80/25 for TD-9727)
REWIND OUTPUT
INPUT TEMP.DAT
COPY
END
```

If the file is to be used imediately, do not delete the disk file. If not, delete the disk file as it is very large (50,000 records; 495 characters/record). This is done by the command

DELETE TEMP.DAT

If you are ready to run SURFOB, type

SURFOB TEMP.DAT,FILE.OUT

where FILE.OUT is any file name under the PERKIN-ELMER naming convention. FILE.OUT is then automatically assigned by the SURFOB job control stream. When SURFOB begins execution, output shown in figure 1 is displayed on the console and input solicitation begins. The user in prompted for station number, the observation hour, beginning and ending dates for data inclusion. Enters are echoed back to the screen for checking. If a bad entry was made, you may enter it again. When the program begins reading data, the message

PROCESSING BEGINS ON STATION nnnnn

is sent to the console. When finished, an END OF TASK CODE displayed along with a criptic little message from the author and note of the file you just created. You should then delete the

TEMP.DAT file as illustrated above. Your file FILE.OUT is ready for further processing by program SUMERG. This file is an 80 character file containing the temperature, relative humidity, wind speed, wind direction, and state of the weather for the observation of the hour requested.

CARD PUNCHING & VERIFYING INSTRUCTIONS

Symbol	*Function
D	Duplicate
P	Punch
S	Skip
V	Verify
L	Left justify

PROGRAM NAME: SURFOB

PROGRAM NUMBER:

DATE:

SOURCE DOCUMENT CARD FORM USED:

PREPARED BY: BRADSHAW

PAGE 1 of 1

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
Card 1.	1	22	22		Six (6) fields
1.1 Station Number	1	5	5		ASO 5-digit station Id
1.2 Observation Time	7	8	2		Local Time (00-24), I2, right
1.3 Year Begin Inclusion	10	11	2		I2, (yy) right justify
1.4 Date Begin Inclusion	12	15	4		I4 (mmdd) right justify both fields ex. 0101
1.5 Year End Inclusion	17	18	2		I2 (yy) right justify
1.6 Date End Inclusion	19	22	4		I4, (mmdd), right just both
User Input -- Unit 5					
Program Output -- Unit 6					
Original ASO's -- Unit 1					
File for SUMERG -- Unit 2					

Program SELECT -- User's Guide

Programmed: Larry S. Bradshaw

Systems for Environmental Management

P.O. Box 3776

Missoula, Montana 59806

Language: ASCII/ANSI Standard 1977 FORTRAN

Machine: PERKIN-ELMER 3220 Mini-computer

Northern Forest Fire Laboratory

Missoula, Montana

Usage: Interactive or Batch

Function: Creates NFFL disk file of daily NCC summary data from TD-9727 for user selected stations. File is then used by SUMERG.

Program SELECT

This very simple program prompts the user for the total number of stations and then, one at a time, prompts for the station number. When entering the station number, you must use the six-digit number from the climatic index. If you use the five-digit ASO station number, no matches will occur. To initiate program SELECT merely type:

```
SELECT MASTER.DAT,SUM.DAT
```

where MASTER.DAT is the file containing all the summary data (copied from the blocked tape to disk with the COPY utility), and SUM.DAT is the output file of selected station summaries. MASTER.DAT must exist on the system, SUM.DAT is created.

CARD PUNCHING & VERIFYING INSTRUCTIONS

Symbol	*Function
D	Duplicate
P	Punch
S	Skip
V	Verify
L	Left justify

PROGRAM NAME: SELECT

PROGRAM NUMBER | DATE

SOURCE DOCUMENT CARD FORM USED

PREPARED BY: BRADSHAW

PAGE 1 of 1

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
Card 1.	1	2	2		One (1) field
1.1 Total number stations	1	2	2		N stations to be SELECTed
Card(s) 2 through N	1	6	6		One (1) field
For each station one card with Climatic (six-digit) station ID number					
	1	6	6		I6, right justified
User Input -- Unit 5					
Program Output -- Unit 6					
All station Data -- Unit 1					
Selected Stn Data-- Unit 2					

Program SUMERG -- User's Guide

Programmed: Larry S. Bradshaw
Systems for Environmental Management
P.O. Box 3776
Missoula, Montana 59806

Language: ASCII/ANSI Standard 1977 FORTRAN

Machine: PERKIN-ELMER 3220 Mini-computer
Northern Forest Fire Laboratory
Missoula, Montana

Usage: Interactive or batch

Function: Merges data files created by SURFOB (and perhaps SELECT) into a fire-weather formatted data file. File is then available for analysis by any fire-weather oriented system.

Program SUMERG

The program is initiated by the statement:

```
SUMERG file1,file2,file3
```

where: file1 is the name of the file created by SURFOB,
file2 is the name of the file created by SELECT, and
file3 is the name of the file that the fire-weather formatted records will be written to.

File1 and file2 must exist, SUMERG will create file3. User input and output is to units 5 and 6 repsectively. SUMERG will prompt the user for the six-digit station code and data inclusion dates.

CARD PUNCHING & VERIFYING INSTRUCTIONS

Symbol	*Function
D	Duplicate
P	Punch
S	Skip
V	Verify
L	Left justify

PROGRAM NAME: SUMERG

PROGRAM NUMBER | DATE

SOURCE DOCUMENT CARD FORM USED

PREPARED BY: BRADSHAW | PAGE: 1 of 1

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
Card 1.	1	20	20		Five (5) fields
1.1 -- Station Number	1	6	6		I6, right justified
1.2 -- Year to Begin Inclusion	8	9	2		I2 (yy)
1.3 -- Date to Begin Inclusion	10	13	4		I4 (mmdd)
1.4 -- Year to End Inclusion	15	16	2		I2 (yy)
1.5 -- Date to End Inclusion	17	20	4		I4 (mmdd)
User Input -- Unit 5					
Program Output -- Unit 6					
Summary Data -- Unit 1					
SURFOB File -- Unit 2					
Merged File -- Unit 15					

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CLIMATOLOGY SOFTWARE PACKAGE

USER'S GUIDE

LARRY S. BRADSHAW

Research Meterologist

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Identification

PROGRAM	Climatology Software Package
LANGUAGE	ASCII Standard FORTRAN
MACHINE	FCCC UNIVAC 1100
USAGE	BATCH or DEMAND (132 character terminal)
PROGRAMMED	Larry S. Bradshaw Systems for Environmental Management P.O. Box 3776 Missoula, Montana 59806 in cooperation with Fire Effects and Use Research Work Unit 2110 Dr. James E. Lotan, Program Manager Intermountain Forest and Range Experiment Station Northern Forest Fire Laboratory Drawer G Missoula, Montana 59806

Summary

Described in this manual is a series of computer programs designed to aid in developing climatic summaries from data stored in the National Fire Weather Library (Furman and Brink, 1975). Collectively known as the Climatology Software Package, these programs provide methods for standard summaries of the climatological data in the NFWL. There are two types of programs.

Five basic climatology programs (SUMMARY, PRECIP1, PRECIP2, WINDS, and THREEWAY) analyze data by 10-day and monthly periods directly from data in the fire-weather library.

The second set consists of three averaging programs (1, 2, and 3) which adjust results from climatology programs to smooth variances introduced by short periods of record (less that 10 years) at some stations, or by periodically incomplete data during the pre- and post-fire seasons. (For example, many lookouts in the Northwest typically have full data records for the months of July and August, and quite varied collections of data from June and September. Others were discontinued as weather stations in the early 1970's with the advent of airborne fire patrols). The averaging programs use nearby stations with more complete data to compute comparative ratios by 10-day and monthly periods. These ratios are then weighted and applied to the short record station to produce smoothed mean values for a short record station. The averaging programs are based upon methods described by Finklin (1982).

Environment

The climatology software package is designed for use on the USDA, Fort Collins Computer Centers (FCCC) UNIVAC 1100 series computer. The programs are archived on mass storage at FCCC and may be run in either batch or demand mode (132 character terminals only). The programs are stored in the file SEM*CLIM on the UNIVAC 1100, but in case of non-use for over 45 days, the programs are archived and must be restored to active status. This may be done via the @RESTORE command

```
@RESTORE,A SEM*CLIM(1).
```

or, preferably with the free overnight restore service via the @SAVE command

```
@SAVE,B SEM*CLIM(1).
(blank line or record following SAVE command)
```

Program execution is then initiated with the @XQT command. The programs are compiled with the level 9R1 ASCII FORTRAN (@FTN) compiler which contains all the features of FORTRAN standard X3.9-1978. The relocatable elements are mapped into the executable element with the level 22R1 @MAP processor at FCCC. The executable elements are:

```
SEM*CLIM.SUMMARY
SEM*CLIM.PRECIP1
SEM*CLIM.PRECIP2
SEM*CLIM.WINDS
SEM*CLIM.THREEWAY
SEM*CLIM.AVERAGE1
SEM*CLIM.AVERAGE2
SEM*CLIM.AVERAGE3
```

The programs may be run in either batch or demand mode, but batch is preferred. Users may either enter the entire input stream or use the @ADD capabililtes of UNVIAC to initiate job streams.

Data Sources

The primary data source is the National Fire Weather Library. Methods for obtaining a data file for analysis are completely described in The National Fire Weather Library: What it is and how to use it by Furman and Brink (1975). NFWL data retrieval software creates a data file directly available for analysis on the UNIVAC 1100 series computer at FCCC.

Instructions for accessing weather data and creating a file for use by the climatology programs are briefly summarized in appendix A for persons not having immediate access to Furman and Brink's publication.

A user input stream is required for each program in the package. The input stream assigns the data files, initiates program execution, and contains program execution instructions. The averaging programs require no external fire-weather files, only a user input stream.

Fire weather data is always read from logical unit 15. User input streams are read from logical unit 5, and program output is to unit 6.

References

Finklin, Arnold I.
Techniques for summarizing climatic data for land managers. U.S. Department of Agruculture, Forest Service, Intermountain Forest and Range Expermiment Station, General Technical Report, INT-___. (In preperation)., 1982.

Furman, R. William and Glen E. Brink
The national fire-weather library: what it is and how to use it. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-19, 8 p., 1975.

Climatology Programs

There are five general climatology programs: SUMMARY, PRECIP1, PRECIP2, WINDS, and THREEWAY. PRECIP1, PRECIP2, WINDS, and THREEWAY all use the same user input stream. SUMMARY needs several more parameters. All five programs require a data file from the National Fire Weather Library. In the following examples, this file is called WEATHERFILE and is assummed to be resident on FCCC mass storage. Appendix A or Furman and Brink's publication provide instructions on how to create this data file.

All of the programs allow multiple station analysis, the only restriction is that the order of station analysis be the same as that on the fire-weather data file. Input cards are simply sequenced in ascending station number order. Additionally, more that one program may be executed under one @RUN card. The end of a current input stream is signified by the @EOF card which would then be followed by another @XQT card and its associated user input stream. Data files are automatically rewound before program execution. Also in program SUMMARY you may run multiple parameters by including input cards to specify the parameter to be summarized. Again, the fire-weather data file is rewound as needed. The first page of output from each program is a one-page data summary that tabulates by 10-day periods, what years have have data in the sample. This information is very important when intepreting the reliability of data summaries and is discussed in more detail in the averaging program section.

Only program THREEWAY has a limitation in its execution: only five (5) months of data may be analyzed in a single pass. For stations with more than 5 months of data, simply have two (or three) input cards for the same station and make sure all months are covered. The input may be in any order.

Program SUMMARY

Function: This program produces from one to five climatological summary tables for the following fire-weather observation elements.

1. Dry Bulb Temperature (deg. F, at observation)
2. Maximum Daily Temperature (deg. F)
3. Minimum Daily Temperature (deg. F)
4. Mean Daily Temperature (deg. F, (max + min)/2)
5. Relative Humidity (%, at observation)
6. Maximum Relative Humidity (%)
7. Minimum Relative Humidity (%)
8. Mean Relative Humidity (%, (max + min)/2)

Table Formats: There are five table formats available from program SUMMARY, each stratified by 10-day and monthly periods.

Table 1: Mean, standard deviation, median, highest period average and year of occurrence, lowest period average and year of occurrence, period high and low values and years of occurrence of each, and the mean, standard deviation, and median value for period high and low values for their respective years of occurrence (table 1).

Table 2: Percent frequency distributions of daily values in selected class intervals (table 2).

Table 3: Percent frequency distributions of period maximum values in selected class intervals (table 3).

Table 4: Percent frequency distributions of period minimum values in selected class intervals (table 4).

Table 5: Number of days selected benchmark values are surpassed (most applicable to temperature data, table 5).

Program limitations: None

Program Use: One input card is required for each parameter and/or station to be analyzed. The following FCCC runstream will produce the output exemplified in tables 1 through 5. Input formats for program SUMMARY are detailed in table 6.

```
1.  @RUN,P RUNID,ACCOUNT,QUALIFIER,15,1000
2.  @ASG,A WEATHERFILE.
3.  @USE 15.,WEATHERFILE.
4.  @ASG,A SEM*CLIM.
5.  @XQT SEM*CLIM.SUMMARY
6.  DRY BULB TEMPERATURE     240112TROY RANGER ST      1850. 12345050163113172
7.  @EOF
8.  @FIN
```

Cost: Program summary, with a P priority (overnight) cost about 14 cents per station per parameter for stations with around 1900 days observations.

Output: There is one page per summary parameter per table per station.

Table 1: Example output from table SUMMARY table number 1 for Dry Bulb Temperature

Table 2: Example output from SUMMARY table number 2 for Dry Bulb Temperature

DRY BULB TEMPERATURE

PERCENTAGE FREQUENCY DISTRIBUTION OF DAILY VALUES
GIVEN TO TENTHS PERCENT, DECIMAL POINT OMITTED

STATION NUMBER 24011 TRY PENNSYLVANIA

1953-1972

PER. BEGINS	BELOW 0	0 TO 4	5 TO 9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	85 TO 89	90 TO 94	95 TO 99	100 AND ABOVE	PER. BEGINS
MAY 1																							MAY 1
MAY 11																							MAY 11
MAY 21																							MAY 21
JUN 1												14	57	100	171	243	243	71	71	29			JUN 1
JUN 11												33	114	171	143	171	91	171	93	29			JUN 11
JUN 21												33	33	100	156	144	167	144	78	44	11		JUN 21
JUL 1											11		33	78	67	122	144	144	200	78	122	11	JUL 1
JUL 11													11	67	56	89	144	211	144	189	67	22	JUL 11
JUL 21													10	30	51	51	111	141	202	313	91		JUL 21
AUG 1													10	30	40	90	50	200	130	190	180	20	AUG 1
AUG 11													20	40	90	71	30	220	250	90	100	33	AUG 11
AUG 21												9	55	73	91	145	145	145	118	155	64		AUG 21
SEP 1											10	40	50	120	120	100	130	220	130	20	10		SEP 1
SEP 11										13	13	91	130	156	195	130	78	65	117	13			SEP 11
SEP 21											20	120	150	120	120	130	60	120	60	40			SEP 21
OCT 1											200	30	200	80	200	200	40						OCT 1
OCT 11											333		667										OCT 11
OCT 21																							OCT 21
NOV 1																							NOV 1
NOV 11																							NOV 11
NOV 21																							NOV 21

MONTH																							MONTH
MAY																							MAY
JUN												24	52	133	154	183	133	114	81	33	4		JUN
JUL											4		14	57	57	90	133	190	183	137	90	11	JUL
AUG												3	33	68	74	133	97	187	134	145	113	15	AUG
SEP										4	13	75	93	141	145	124	97	145	132	29	4		SEP
OCT											214	71	357	71	179	179	35						OCT
NOV																							NOV

Table 3: Example output from SUMMARY table 3 for Dry Bulb Temperature

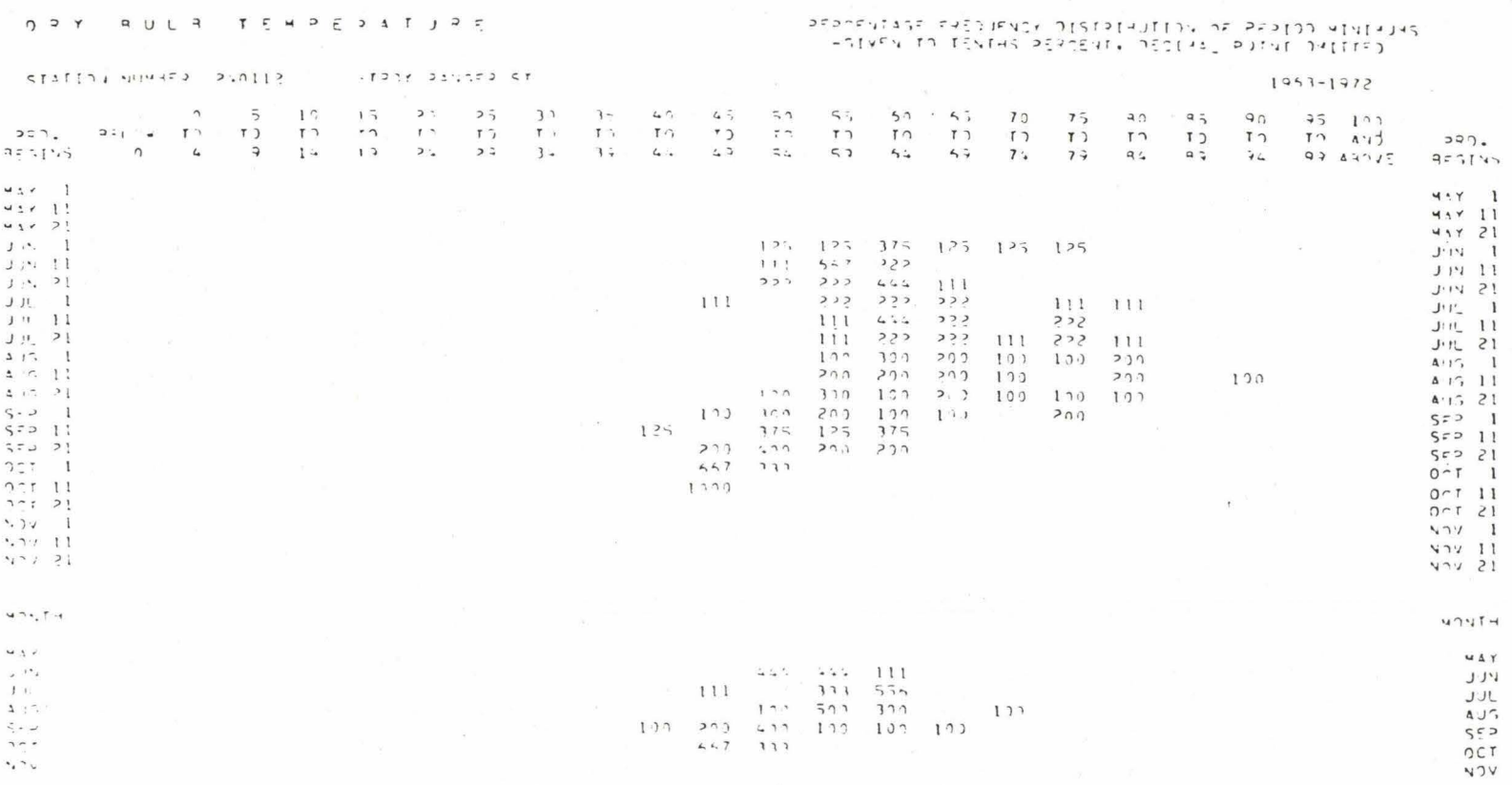
DRY BULB TEMPERATURE — PERCENTAGE FREQUENCY DISTRIBUTION OF PERIOD MAXIMUMS
GIVEN TO TENTHS PERCENT, DECIMAL POINT OMITTED

STATION NUMBER 24011 — TEST DENVER ST — 1963-1972

PER. BEGINS	0 TO 0	1 TO 5	6 TO 10	11 TO 15	16 TO 20	21 TO 25	26 TO 30	31 TO 35	36 TO 40	41 TO 45	46 TO 50	51 TO 55	56 TO 60	61 TO 65	66 TO 70	71 TO 75	76 TO 80	81 TO 85	86 TO 90	91 TO 95	96 TO 100	101 AND ABOVE	PER. BEGINS
MAY 1																							MAY 1
MAY 11																							MAY 11
MAY 21																							MAY 21
JUN 1															250	375		125	250				JUN 1
JUN 11																111	444	222	222				JUN 11
JUN 21																222	333	222	222	111			JUN 21
JUL 1																111		222	222	333	111		JUL 1
JUL 11																	111		333	333	222		JUL 11
JUL 21																		111	444	444			JUL 21
AUG 1																	100		200	600	100		AUG 1
AUG 11																	100	200	400	100	200		AUG 11
AUG 21																	200	200	100	500			AUG 21
SEP 1																200	100	500	100	100			SEP 1
SEP 11														250	125		125	375	125				SEP 11
SEP 21															200	400		200	200				SEP 21
OCT 1														333	333	333							OCT 1
OCT 11												1000											OCT 11
OCT 21																							OCT 21
NOV 1																							NOV 1
NOV 11																							NOV 11
NOV 21																							NOV 21

MONTH	MONTH
MAY	MAY
JUN	JUN
JUL	JUL
AUG	AUG
SEP	SEP
OCT	OCT
NOV	NOV

Table 4: Example output for SUMMARY table 4 for Dry Bulb Temperature



5: Example output from SUMMARY table 5 for Dry Bulb Temperature

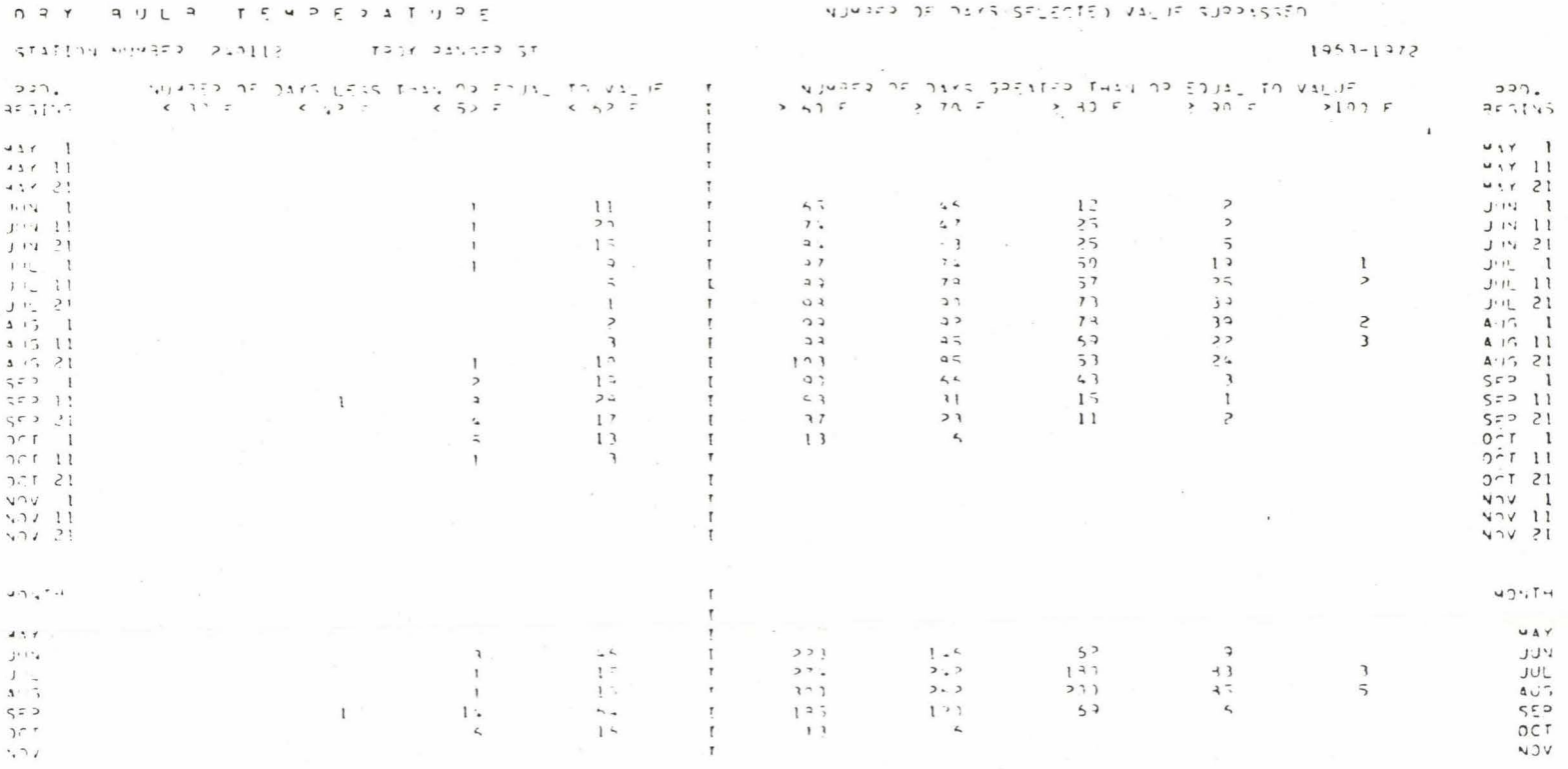


Table 6. Input Format Sepcifications for Program SUMMARY 55-6560-13

CARD PUNCHING & VERIFYING INSTRUCTIONS	Symbol	*Function
	D	Duplicate
	P	Punch
	S	Skip
	V	Verify
	L	Left justify

PROGRAM NAME SEM*CLIM.SUMMARY	
PROGRAM NUMBER	DATE 12/81
SOURCE DOCUMENT CARD FORM USED	
PREPARED BY Bradshaw	PAGE 1 of 1

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
Parameter to be summarized	1	25	25	P/L	Enter paramter exactly as
					spelled below, left justified!
DRY BULB TEMPERATURE					RELATIVE HUMIDITY
MAXIMUM DAILY TEMPERATURE					MAXIMUM RELATIVE HUMIDITY
MINIMUM DAILY TEMPERATURE					MINIMUM REALTIVE HUMIDITY
MEAN DAILY TEMPERATURE					MEAN RELATIVE HUMIDITY
STATION NUMBER	26	31	6	P	AFFIRMS STATION NUMBER (I6)
STATION NAME	32	51	20	P	AFFIRMS STATION NAME (5A4)
STATION ELEVATION	52	57	6	P	(F6.0, right justified)
TABLE OUTPUT OPTIONS	58	62	5	P	Enter table(s) requested.
entries are positonal --	table	1 =	column	58,	table 5 = column 62
if a table is requested, enter the number in the					correct column. If not,
leave the column blank, or	enter	a zero.			
DATE TO BEGIN ANALYSIS	63	68	6	P	Enter date (MMDDYY)
DATE TO END ANALYSIS	69	74	6	P	Enter date (MMDDYY)

Program PRECIP1

Function: Generates two precipitation frequency distribution tables.

Table 1: Daily precipitations amounts in selected class intervals (table 7).

Table 2: Period total precipitation amounts in selected class intervals (table 8).

Limitations: None

Program Use: Both tables are always produced and one input card is required for each station. Input formats for PRECIP1 are detailed in table 9. The following FCCC control sequence will run PRECIP1 on data file "WEATHERFILE" which is assumed to already exist on FCCC mass storage and create the output displayed in tables 7 and 8.

```
1.  @RUN,P RUNID,ACCOUNT,QUALIFIER,15,1000
2.  @ASG,A WEATHERFILE.
3.  @USE 15.,WEATHERFILE.
4.  @ASG,A SEM*CLIM.
5.  @XQT SEM*CLIM.PRECIP1
6.       240112TROY RANGER STATION 1850.      070163083170
7.  @EOF
8.  @FIN
```

Costs: On a P priority, PRECIP1 costs about 8 cents per 1900 record station.

Output: There are two pages of output per station.

Table 7: Example output from PRECIP1 -- Percent Frequency of Daily Amounts

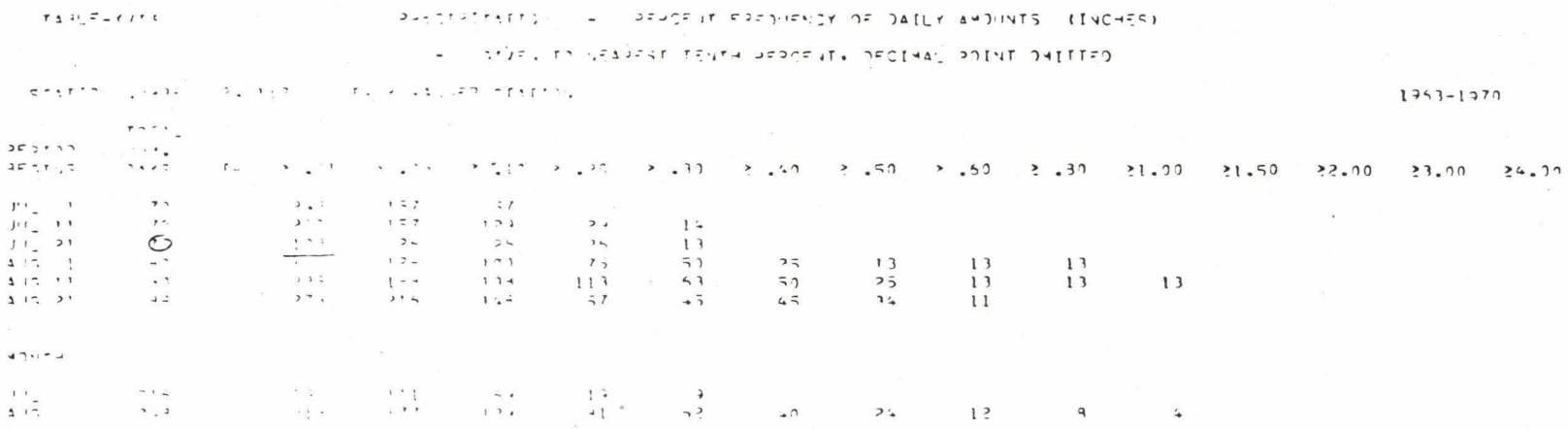


Table 8: Example output for PRECIP1 -- Percent Frequency of Period Totals

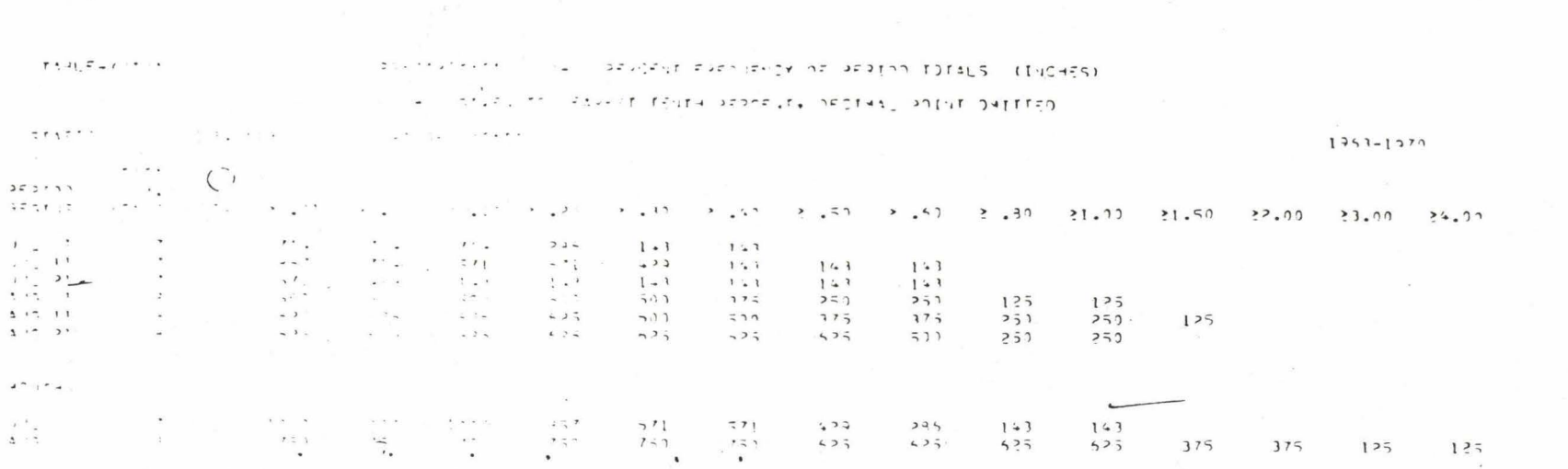


Table 9. User input format for programs PRECIP1, PRECIP2, WINDS, and THREEWAY

CARD PUNCHING & VERIFYING INSTRUCTIONS	Symbol	*Function
	D	Duplicate
	P	Punch
	S	Skip
	V	Verify
	L	Left justify

PROGRAM NAME PRECIP1/PRECIP2/WINDS/THREEWAY	
PROGRAM NUMBER	DATE 8/1/79
SOURCE DOCUMENT CARD FORM USED	
PREPARED BY Larry Bradshaw	PAGE 1 of 1

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
Blank field	1	5	5	S	Leave Blank
Station Number	6	11	6	P	AFFIRMS Station Number (I6)
Station Name	12	31	20	P	Punch station name up to 20 characters- Format (5A4)
Station Elevation	32	41	10	P	Format (F10.0) decimal punched unless right justified
Date to Begin Analysis	42	45	4	P	Enter month and day (MMDD)
Year to Begin Analysis	46	47	2	P	Enter year (YY)
Date to End Analysis	48	51	4	P	Enter month and day (MMDD)
Year to End Analysis	52	53	2	P	Enter year (YY)

Program PRECIP2

Function: Displays a table containing mean, standard deviation, median, highest period precipitation amount recorded and year of occurrence, maximum daily precipitation amount recorded and year of occurrence, and the mean, standard deviation and median precipitation amount of daily values for the year recording the maximum daily amount. Example output from PRECIP2 is shown in table 10, and the input requirements shown in table 9.

Limitations: None

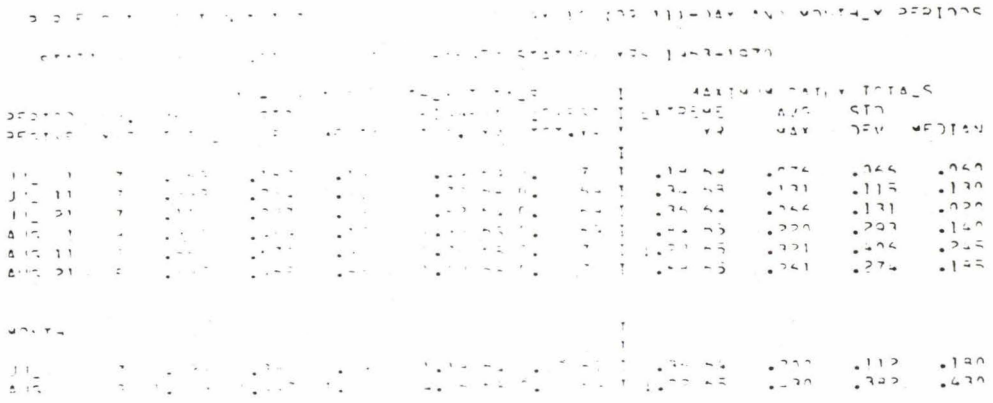
Program Use: One input card is required for each station to be analyzed and the input parameters are the same as those for PRECIP1. The following FCCC control stream will generate the output in table 10 using the weather file "WEATHERFILE."

```
1.  @RUN,P RUNID,ACCOUNT,QUALIFIER,15,1000
2.  @ASG,A WEATHERFILE.
3.  @USE 15.,WEATHERFILE.
4.  @ASG,A SEM*CLIM.
5.  @XQT SEM*CLIM.PRECIP2
6.       240112TROY RANGER STATION 1850.     070163083170
7.  @EOF
8.  @FIN
```

Cost: A P priority (overnight) run of PRECIP2 will cost about 15 cents per 1900 record station.

Output: There is one page of output per station.

Table 10: Example output from PRECIP2



Program WINDS

Function: Computes a table of percentage frequency of co-occurrence of wind speed with wind direction in selected class intervals (see table 11).

Limitations: None

Program Use: One input card is required for each station and the parameters are the same as those in the other climatology programs (table 9). The following control stream will generate the output exemplified in table 11.

```
1.  @RUN,P RUNID,ACCOUNT,QUALILFIER,10,1000
2.  @ASG,A WEATHERFILE.
3.  @USE 15.,WEATHERFILE.
4,  @ASG,A SEM*CLIM,
5.  @XQT QEM*CLIM.WINDS
6.       240112TROY RANGER STATION 1850.      070163083170
7.  @EOF
8.  @FIN
```

Cost: Running WINDS on a P (overnight) priority will cost about 10 cents per 1900 record station.

Output: One page of output per month per station.

Table 11:. Example output from WINDS

TABLE II: WIND SPEED - DIRECTION
PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION FOR SELECTED SPEED INCREMENTS
-GIVEN TO TENTHS PERCENT, DECIMAL POINT OMITTED

STATION NUMBER 343113 [illegible] STATION 1963-1972

10-DAY PERIOD BEGINNING JUL 1

	WIND SPEED, MPH													
	0-3		4-7		8-12		13-18		19-24		>25		TOTAL	AVG
DIR.	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	SPEED
NE			2	29	1	14							3	43	6.3
E	3	43	2	29									5	72	4.8
SE	10	145	14	203	3	43							27	391	4.7
S	2	29	6	87	3	43	1	14					12	174	7.1
SW			3	43									3	43	5.7
W			3	43									3	43	5.0
NW	3	43	5	87	2	29							11	159	5.4
N	2	29	1	14	2	29							5	72	5.4
CLM															
TOT	20	290	39	565	11	159	1	14					69	1000	

10-DAY PERIOD BEGINNING JUL 11

	WIND SPEED, MPH													
	0-3		4-7		8-12		13-18		19-24		>25		TOTAL	AVG
DIR.	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	SPEED
NE	1	14	1	14									2	29	3.5
E															
SE	9	129	15	223	2	29							27	386	4.3
S	2	29	15	214	3	43							20	286	5.3
SW	1	14	5	86									7	100	4.6
W			1	14									1	14	5.0
NW			8	114	2	29							10	143	5.5
N	1	14	1	14	1	14							3	43	5.3
CLM															
TOT	14	200	49	686	8	114							70	1000	

10-DAY PERIOD BEGINNING JUL 21

	WIND SPEED, MPH													
	0-3		4-7		8-12		13-18		19-24		>25		TOTAL	AVG
DIR.	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	SPEED
NE			2	27	2	27							4	53	7.5
E	3	40	2	27									5	67	3.4
SE	14	187	9	120	1	13							24	320	3.6
S	3	40	4	53	3	40							10	133	5.3
SW	1	13	7	93	1	13							9	120	5.0
W			2	27									2	27	4.0
NW	2	27	8	107	1	13							11	147	5.4
N	1	13	7	93	2	27							10	133	5.1
CLM															
TOT	24	320	41	547	10	133							75	1000	

10-DAY PERIOD BEGINNING AUG 1

	WIND SPEED, MPH													
	0-3		4-7		8-12		13-18		19-24		>25		TOTAL	AVG
DIR.	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	SPEED
NE			2	25									2	25	5.0
E	1	13											1	13	3.0
SE	19	238	3	38	1	13							23	288	2.4
S	4	51	8	101	7	88							19	241	5.0
SW	10	127	5	63									15	190	2.3
W			2	25	2	25							4	51	7.0
NW			5	63	4	51							9	114	7.1
N	1	13	3	38	3	38							7	88	5.0
CLM															
TOT	34	438	33	354	17	215							79	1000	

10-DAY PERIOD BEGINNING AUG 11

	WIND SPEED, MPH													
	0-3		4-7		8-12		13-18		19-24		>25		TOTAL	AVG
DIR.	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	SPEED
NE	3	33											3	33	1.3
E															
SE	9	117	7	91	6	78							22	285	4.4
S	8	104	7	91	2	26							17	221	4.1
SW	4	52	6	78	3	39							13	169	4.5
W			2	26									2	26	4.0
NW	2	26	8	104	3	39							13	169	5.1
N	1	13	4	52	1	13			1	13			7	91	5.7
CLM															
TOT	27	352	34	442	13	169			1	13			77	1000	

10-DAY PERIOD BEGINNING AUG 21

	WIND SPEED, MPH													
	0-3		4-7		8-12		13-18		19-24		>25		TOTAL	AVG
DIR.	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	N.	PCT	SPEED
NE			1	12									1	12	5.0
E	1	12	2	25									3	37	3.7
SE	11	136	13	162	3	37							27	333	4.4
S	10	122	6	73	2	24							18	220	3.3
SW	5	61	6	73	2	24	1	12					14	171	4.6
W	2	24	2	24									4	49	4.0
NW	6	73	4	49	2	24							12	146	3.9
N	1	12	2	24	3	37							6	73	5.3
CLM															
TOT	36	438	36	439	12	146	1	12					82	1000	

Program THREEWAY

Function: Displays three-way percentage frequency of co-occurrence of selected class values of observation time temperature, wind speed, and relative humidity. Output is exemplified in table 12.

Limitations: **Only five (5) months may be analyzed at a time.** For stations with greater than five months data, the input stream should have two identical input cards with the first having the dates set to cover 5 months, and the second for the same station, but the dates to cover subsequent months.

Program Use: One input card is required per station per five (5) months analysis and the input requirments are indentical to the other programs (table 9), save SUMMARY. The following FCCC runstream will cause THREEWAY to produce the output in table 12.

```
1.  @RUN,P RUNID,ACCOUNT,QUALIFIER,15,1000
2.  @ASG,A WEATHERFILE.
3.  @USE 15.,WEATHERFILE.
4.  @ASG,A SEM*CLIM.
5.  @XQT SEM*CLIM.THREEWAY
6.       240112TROY RANGER STATION 1850.      070163083170
7.  @EOF
8.  @FIN
```

Cost: Running THREEWAY on a P (overnight) priority will cost about 31 cents per station with 1900 records and five months in the analysis.

Output: Four pages of output per station per month are produced.

Table 12: Example output from THREEWAY

TABLE-12: TEMPERATURE - RELATIVE HUMIDITY - WIND SPEED
PERCENTAGE FREQUENCY OF OCCURRENCE FOR SELECTED COMBINATIONS
GIVEN TO TENTHS PERCENT, DECIMAL POINT OMITTED

STATION NUMBER 24011 TRAY RAPIDS STATION 1959-1979

10-DAY PERIOD BEGINNING AUG 21

WIND SPEED 0-4 MPH

TEMP. DEG F	RELATIVE HUMIDITY 1 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 TO 60	61 TO 70	71 TO 80	81 TO 90	91 TO 100
>100										
95-99	11	23	11							
90-94		11	11							
85-89		45	23	11						
80-84		23	34							
75-79		11	34	34	45					
70-74			11	34	45	11	11			
65-69					11	23	11			
60-64					11	11	11		11	
55-59						11	11	11	11	
50-54										
45-49										
40-44										
35-39										
30-34										
<30										
TOTAL	11	114	125	80	114	57	45	11	23	
NUMBER	1	10	11	7	10	5	4	1	2	0

WIND SPEED 5-9 MPH

TEMP. DEG F	RELATIVE HUMIDITY 1 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 TO 60	61 TO 70	71 TO 80	81 TO 90	91 TO 100
>100										
95-99		11								
90-94		45	23	11						
85-89		23	11							
80-84		11	45	11	11					
75-79			11							
70-74			23	11	11					
65-69				23	11	23				
60-64					11	11		11		
55-59						11				
50-54									11	
45-49										
40-44										
35-39										
30-34										
<30										
TOTAL		91	114	57	45	45		11	11	
NUMBER	0	8	10	5	4	4	0	1	1	0

WIND SPEED 10-14 MPH

TEMP. DEG F	RELATIVE HUMIDITY 1 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 TO 60	61 TO 70	71 TO 80	81 TO 90	91 TO 100
>100										
95-99										
90-94			11	11						
85-89										
80-84				11						
75-79				11						
70-74										
65-69										
60-64										
55-59										
50-54										
45-49										
40-44										
35-39										
30-34										
<30										
TOTAL			11	11	23					
NUMBER	0	0	1	1	2	0	0	0	0	0

WIND SPEED 15-19 MPH

TEMP. DEG F	RELATIVE HUMIDITY 1 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 TO 60	61 TO 70	71 TO 80	81 TO 90	91 TO 100
>100										
95-99										
90-94										
85-89										
80-84										
75-79										
70-74										
65-69										
60-64										
55-59										
50-54										
45-49										
40-44										
35-39										
30-34										
<30										
TOTAL										
NUMBER	0	0	0	0	0	0	0	0	0	0

WIND SPEED GREATER/EQUAL 20 MPH

TEMP. DEG F	RELATIVE HUMIDITY 1 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 TO 60	61 TO 70	71 TO 80	81 TO 90	91 TO 100
>100										
95-99										
90-94										
85-89										
80-84										
75-79										
70-74										
65-69										
60-64										
55-59										
50-54										
45-49										
40-44										
35-39										
30-34										
<30										
TOTAL										
NUMBER	0	0	0	0	0	0	0	0	0	0

TOTAL NUMBER

	0
57	5
125	11
114	10
148	13
148	13
159	14
102	9
80	7
57	5
11	1
	0
	0
	0
	0
	0
1000	
	88

Averaging Programs

Data in the fire-weather library is often incomplete and many stations have opening dates that are directly related to the year's fire-weather. Unusually warm and dry pre- and post-fire season years have data, more 'normal' years do not. Thus a bias is introduced in the database. Other problems arise with some stations (lookouts usually) having only a short (eight to ten year) period of record, while nearby ranger stations have longer (15 to 25) year records.

The first page of output from each of the climatology programs is a tablulation of 10-day periods, by year, that contain, or do not contain data. Table 13 is an example of this and is a rather typical example of a ranger station's data count in northern Montana or Idaho for the 1960's decade.

Three programs have been written from techniques described by Finklin (1982). The programs are cleverly name AVERAGE1, AVERAGE2, and AVERAGE3. They are independent from each other and use results of the climatology programs and other available summaries (standard climate stations) to adjust biased and short-term summaries to more truely represent the local climate.

Input for the programs comes from the user, no fire-weather files from the NFWL are used and consists of some control information and 10-day and monthly mean values of various parameters from climatology program runs and/or climate station summeries (when adjusting precipitation).

Output tables are fashioned after those presented by Finklin and users desiring more information on these computations and interpretations should consult that document.

Table 13: Data count output example from all Climatology programs.

PROGRAM SUMMARY

DATA COUNT BY YEARS AND 10-DAY PERIODS

PERIOD BEGINS	YEARS HAVING DATA FOR EACH PERIOD	TOTAL NUM YEARS
MAY 1	62 63 64 68 69 70	6
MAY 11	62 63 64 65 66 68 69 70	8
MAY 21	62 63 64 65 66 67 68 69 70	9
JUN 1	60 62 63 64 65 66 67 68 69 70	10
JUN 11	60 62 63 64 65 66 67 68 69 70	10
JUN 21	60 61 62 63 64 65 66 67 68 69 70	11
JUL 1	60 61 62 63 64 65 66 67 68 69 70	11
JUL 11	60 61 62 63 64 65 66 67 68 69 70	11
JUL 21	60 61 62 63 64 65 66 67 68 69 70	11
AUG 1	60 61 62 63 64 65 66 67 68 69 70	11
AUG 11	60 61 62 63 64 65 66 67 68 69 70	11
AUG 21	60 61 62 63 64 65 66 67 68 69 70	11
SEP 1	60 63 64 65 66 67 68 69 70	9
SEP 11	60 63 64 65 66 68 69 70	8
SEP 21	60 63 65 66 68 69 70	7

Program AVERAGE1

Function: Computes adjusted 10-day and monthly mean values of temperature and relative humidity data by means of a modified difference method for a station with a short period of record (usually a lookout). It uses period mean values for the short-term station together with those from a nearby weather station with a longer period of record (usually a ranger station).

Usage: AVERAGE1 uses only a user input stream. The first card sets up run parameters, and subsequent cards hold sequential 10-day period mean parameter values for both the short and long-term stations. These are then followed by sequential month mean value cards. Input formats are detailed in table 14, and the following run stream would generate the output exemplified by table 15.

```
1.  @RUN,P RUNID,ACCOUNT,QUALIFIER,5,100
2.  @ASG,A SEM*CLIM.
3.  @XQT SEM*CLIM.AVERAGE1
4.  DRY BULB TEMPERATURENINEMILE RS          54017003WILLIAMS PEAK LO    6068
5.  70.1 78.4 (july period 1)
6.  73.2 82.8 (july period 2)
7.  73.9 84.4 (july period 3)
8.  ..... (continue one card per 10-day period, then one per month)
9.  71.2 80.4 (august month mean)
10. @EOF
11. @FIN
```

Cost: AVERAGE1 will always cost the batch minimum of 50 cents.

Output: There is one page of output for each averaged parameter and multilple parameters can be averaged in one run by simply repeating the sequence in lines 4 through 10 above, after line 10, with the information modified as needed.

Table 14. Input Formats for program AVERAGE1 55-6560-13

CARD PUNCHING & VERIFYING INSTRUCTIONS	Symbol	*Function
	D	Duplicate
	P	Punch
	S	Skip
	V	Verify
	L	Left justify

PROGRAM NAME: SEM*CLIM.AVERAGE1
PROGRAM NUMBER | DATE: 12/81
SOURCE DOCUMENT CARD FORM USED
PREPARED BY: Bradshaw | PAGE: 1 of 1

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
1. PARAMETER	1	20	20	P	Parameter Name
2. NAME OF LONG-TERM STATION	21	40	20	P	
3. YEAR LONG-TERM DATA BEGIN	41	42	2	P	right justify
4. YEAR LONG-TERM DATA END	43	44	2	P	right justify
5. MONTH LONG-TERM DATA BEGIN	45	46	2	P	right justify
6. PERIOD LONG-TERM DATA BEG	47	48	2	P	(01 for days 1-10; 02 for 11-
					20; 03 for 21-31) right just.
7. MONTH LONG-TERM DATA END	49	50	2	P	right justify
8. PERIDO LONG-TERM DATA END	51	52	2	P	same as number 6
9. SHORT-TERM STATION NAME	53	72	20	P	
10. YEAR SHORT STATION BEGINS	73	74	2	P	right justify
11. YEAR SHORT STAT DATA END	75	76	2	P	right justify
**** Now, for each 10-day period enter one card with the short-term mean value					
followed by the long-term mean value.					
10-day period mean values	1	10	10	P	FORMAT(2F5.1), decimal punched
				ex.	1234567890 83.1 91.2
******** END OF INPUT STREAM FOR AVERAGE1 **********					

Program AVERAGE2

Function: Computes by a modified ratio method, adjusted and extrapolated (lengthened season) 10-day and monthly average precipitation for a complete fire-weather season at a ranger station having a relatively short season of record.

Usage: AVERAGE2 requires previously computed 10-day average rainfall for the station in question, published monthly normal precipitation from a nearby climatological station of similar elevation, and complete season 10-day average precipitation at two nearby ranger stations for the same period record (also previously computes via climatology program PRECIP2). Input formats for AVERAGE2 are detailed in table 16, and the runstream shown in figure 1 will generate the output shown in table 17.

Cost: Like the other averaging programs the cost to run is the batch minimum of 50 cents.

Output: One page per station.

Table 16. Input Formats for program AVERAGE2

55-6560-13

CARD PUNCHING & VERIFYING INSTRUCTIONS	Symbol	*Function	PROGRAM NAME: SEM*CLIM.AVERAGE2	
	D	Duplicate	PROGRAM NUMBER	DATE 12/81
	P	Punch		
	S	Skip	SOURCE DOCUMENT CARD FORM USED	
	V	Verify		
	L	Left justify	PREPARED BY bradshaw	PAGE 1 of 2

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
CARD NUMBER 1. HEADING	1	80	80	P	any heading, include parameter
INPUT SEQUENCE NUMBER 2 ----------					
2.1 First long term station	1	20	20	P	enter station name
2.2 Second long-term stn.	21	40	20	P	enter station name
2.3 Year Begin	41	42	2	P	year data begin at long-term
2.4 Year data end (long)	43	44	2	P	year long-term data end
2.5 Month data begin	45	46	2	P	month long-term data begin
2.6 Month data end	47	48	2	P	month long-term data end
***** Now for each 10-day period enter the mean precip amounts for station					
2.1 and 2.2 respectively (one card per 10-day period)-					3 periods per month if missing, enter 0.
Mean precip amounts	1	12	12	P	Format (2F6.3)
INPUT SEQUENCE NUMBER 3 ----------					
3.1 Short-term Station	1	20	20	P	Enter short term station name
3.2 first long-term station	21	40	20	P	Same as item 2.1
3.3 second long-term stn	41	60	20	P	Same as item 2.2
3.4 Short year begin	61	62	2	P	Year short data begin
3.4 Short year end	63	64	2	P	Year short data end
3.5 Month short data begin	65	66	2	P	Month short data begin
3.6 Month short data end	67	68	2	P	Month short data end
***** now enter for each 10-day period of the short station (short years too)					
the 10-day mean precip amounts for the three stations in items 3.1, 3.2					
and 3.3 rescpectively. Three per card, one card per period format (3F6.3)					

continues next page

CARD PUNCHING & VERIFYING INSTRUCTIONS	Symbol	*Function	PROGRAM NAME: SEM*CLIM.AVERAGE2	
	D	Duplicate	PROGRAM NUMBER	DATE 12/81
	P	Punch		
	S	Skip	SOURCE DOCUMENT CARD FORM USED	
	V	Verify		
	L	Left justify	PREPARED BY	PAGE 2 of 2

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
Always with three periods per month. If one is missing, enter 0. Means are					
from the same set of years for all three station (defined by short station) and					
are not the same as in input sequence number 2 above. This means two runs of					
Climatology program PRECIP2 for the long term station. One for the long-term					
averages, and one for the short-term averages.					
Mean precip by period	1	18	18	P	**FORMAT (3F6.3) with decimal
INPUT SEQUENCE NUMBER 4 ----------					
4.1 Climatic Station	1	20	20	P	Enter name
4.2 Year data begin	21	22	2	P	Year data at climatic station
4.3 Year data end	23	24	2	P	Year climate station data end
4.4 Month data begin	25	26	2	P	Enter the month that you are
					beginning monthly averages
					Same as entry 2.5
4.5 Month data end	27	28	2	P	Enter last month of monthly
					mean data that you are enter-
					ing. Same as entry 2.6
**** Now enter the monthly mean precipitation at the climate station, one					
card for each month!					
Monthly mean Precip	1	5	5	P	F5.2, decimal punched or right
					justify.
********** END OF AVERAGE2 DATA INPUT **********					

Program AVERAGE3

Function: Computes, using differences from peak-season values, adjusted and extrapolated (lengthened season) 10-day and monthly mean values of temperature and relative humidity values (program SUMMARY) at a ranger or lookout station having a relatively season of observation.

Usage: AVERAGE3 requires 10-day mean parameter values at the ranger station in question (short-season) and complete season 10-day mean values at two nearby ranger stations for the same period of record, preferably 15 to 20 years from previous runs of program SUMMARY. The input format is detailed in table 18, and the runstream shown in figure 2 will produce the output tabulated in table 9.

Cost: AVERAGE3, on a P priority will cost the batch minimum of 50 cents.

Output: There is one page of output per parameter.

Table 18. Input formats for program AVERAGE3

55-6500-13

CARD PUNCHING & VERIFYING INSTRUCTIONS	Symbol	*Function	PROGRAM NAME: SEM*CLIM.AVERAGE3	
	D	Duplicate	PROGRAM NUMBER	DATE: 12/81
	P	Punch		
	S	Skip	SOURCE DOCUMENT CARD FORM USED	
	V	Verify		
	L	Left justify	PREPARED BY	PAGE 1 of 2

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
---- INPUT SEQUENCE NUMBER	1	----------			
1.1 Heading	1	80	80	P	Enter Parameter and other info
---- INPUT SEQUENCE NUMBER	2	----------			
2.1 First long-term station	1	20	20	P	Enter station name
2.2 Second long-term stn	21	40	20	P	Enter second station name
2.3 Year data begin	41	42	2	P	Enter year (YY)
2.4 Year data end	43	44	2	P	Enter year (YY)
2.5 Month data begin	45	46	2	P	Enter month (MM), right just.
2.6 Period data begin	47	48	2	P	01, 02, or 03 right justified
2.7 Month data end	49	50	2	P	Enter month (MM) right just.
2.8 10-day period data ends	51	52	2	P	01, 02, or 03 right justified
**** Now enter mean parameter values for the two stations (items 2.1 and 2.2)					
one card per 10-day period, two entries per card					
10-day mean values	1	10	10	P	Format (2F5.1)
--------- INPUT SEQUENCE NUMBER 3		------			see next page ----------

CARD PUNCHING & VERIFYING INSTRUCTIONS	Symbol	*Function
	D	Duplicate
	P	Punch
	S	Skip
	V	Verify
	L	Left justify

PROGRAM NAME: SEM*CLIM.AVERAGE3
PROGRAM NUMBER:
DATE: 12/81
SOURCE DOCUMENT CARD FORM USED:
PREPARED BY: bradshaw
PAGE: 2 of 2

CARD FIELD	COLUMNS FROM	COLUMNS TO	NO. COLS.	FUNC. *	REMARKS
------- INPUT SEQUENCE NUMBER 3 ----------					SHORT SEASON INFORMATION
3.1 First Short Station	1	20	20	P	enter name, same as 2.1
3.2 Second Short Station	21	40	20	P	enter name, same as 2.2
3.3 Third Short Station	41	60	20	P	enter name
3.4 Short year begin	61	62	2	P	enter year (YY)
3.5 Short year data end	63	64	2	P	enter year (yy)
3.6 Short month data begin	65	66	2	P	Enter month (mm) right justify
3.7 Short period begin	67	68	2	P	01, 02, or 03 right justify
3.8 Short month data end	69	70	2	P	enter month (mm) right justify
3.9 Short period end	71	72	2	P	01, 02, or 03 - right justify
***** Now enter, for each 10-day period, the mean values of the three stations					
3.1, 3.2, and 3.3 respectively. One card per 10-day period, three values					
per card.					
10-day mean short period values	1	15	15	P	Format (3F5.1) with decimal
********** END OF INPUT STREAM FOR AVERAGE3 **********					

Table 19. Example output from program AVERAGE3

DRY BULB TEMPERATURE

1954 - 1970

BEGINNING	NINEMILE (1)	POWELL RS (2)	(9)	(10)	(11)	(12)	(13)	ADJUSTED AVERAGE (14)
MAY 11	63.0	60.9	0.0	-21.4	-21.6	0.0	-21.6	60.1
MAY 21	65.4	63.3	0.0	-19.0	-19.2	0.0	-19.1	62.4
JUN 01	66.2	65.8	0.0	-16.2	-15.7	0.0	-15.9	65.6
JUN 11	70.0	68.8	0.0	-14.4	-12.7	0.0	-13.5	68.0
JUN 21	72.3	70.6	0.0	-12.1	-11.9	0.0	-12.0	69.6
JUL 01	76.4	77.4	75.5	-6.0	-5.1	-6.1	-6.1	75.5
JUL 11	82.7	81.7	80.1	-1.7	-0.8	-1.5	-1.5	80.1
JUL 21	84.4	82.5	81.6	0.0	0.0	0.0	0.0	81.6
AUG 01	82.9	81.4	80.1	-1.5	-1.1	-1.5	-1.5	80.1
AUG 11	82.3	80.0	78.9	-2.1	-2.5	-2.7	-2.7	78.9
AUG 21	76.5	74.2	73.4	-7.9	-8.3	-8.2	-8.2	73.4
SEP 01	74.2	72.3	71.3	-10.2	-10.2	-10.2	-10.2	71.3
SEP 11	67.5	64.0	0.0	-16.9	-18.5	0.0	-17.7	63.9
SEP 21	65.3	61.4	0.0	-19.1	-21.1	0.0	-20.1	61.4
OCT 01	59.1	55.1	0.0	-25.3	-27.4	0.0	-26.3	55.2
OCT 11	54.4	50.0	0.0	-30.0	-32.5	0.0	-31.3	50.3

DRY BULB TEMPERATURE

1954 - 1967

BEGINNING	NINEMILE (3)	POWELL RAN (4)	LOLO RANGE (5)	(6)	(7)	(8)
JUL 01	77.7	75.3	74.6	0.7	1.1	1.9
JUL 11	83.5	82.2	80.7	-0.6	-0.5	-1.7
JUL 21	84.9	82.7	81.9	-0.5	-0.5	-0.3
AUG 01	82.8	81.4	80.3	-1.1	-1.0	-1.0
AUG 11	83.3	80.9	79.8	-1.0	-0.8	-0.9
AUG 21	75.4	72.8	72.1	1.1	1.4	1.3
SEP 01	74.4	72.2	71.4	-0.2	0.1	0.0

Appendices

Appendix A

The National Fire Weather Library: Data Access Instructions

Creation of a Data File for Use in the Climatology Programs

Three items of information are needed to obtain data from the NFWL. They are (1) the six digit code (or codes) of the fire weather station(s) to be analyzed, (2) the years of data to be analyzed, and (3) is the file name containing the lowest station code in the analysis. For example, if the stations to be analyzed are 034567, 245789, and 003452, only the file name that contains station 003452 is needed.

OBTAINING A FILE NAME

A current listing of files and stations within the files may be obtained by executing the following sequence at FCCC.

```
        1         2         3         4
1234567890123456789012345678901234567890
@RUN,P
@ASG,A FIREDATALIB*PROGRAMS.
@XQT FIREDATALIB*PROGRAMS.LISTFILES
@FIN
```

NFWL software creates a listing of file names and stations in the file. The general format follows (Note: ssssss represents the six digit station code, and yy represents the last two digits of the year that data begins (FROM) or ends (THROUGH); nn,mm, and oo represent assorted numbers and letters of the files names).

FILE NAME	STATION YEAR LIMITS FROM	THROUGH	DATE OF LAST UPDATE
FIREDATALIB*nn-mm	ssssssyy	ssssssyy	mmddyy
FIREDATALIB*oo	ssssssyy	ssssssyy	mmddyy
etc.			

Scan the 'station year limits' column until the group containing the lowest six digit station code of station to be analyzed is found. The entire file name (FIREDATALIB*nn-mm) is to be used in place of "FILE" in the following data aquisition sequence.

CREATING A CARD IMAGE FILE FRO USE IN ANALYSIS

In creating a card image file, it is wise to generate a user program file of the data. This allows the date file to be stored in the Mass File Directory at FCCC for 6 days from the date of creation, allowing subsequent runs to access the data without re-creation of the data file by NFWL software. This is particularly helpful in the event of input errors resulting in job termination prior to completion or when several programs will be run on the same data set.

This process is accomplished by executing the following sequence at FCCC. Again, ssssss is a six digit station code, and yy values are beginning and ending years of data inclusion, respectively. If all available years are requested, use yy=00, and yy=99.

```
         1         2         3         4         5         6
1234567890123456789012345678901234567890123456789012345678901234567890

@RUN,
@ASG,A FIREDATALIB*PROGRAMS.
@ASG,A "FILE".
@USE 2.,"FILE".
@ASG,UP NAME,                          (NAME may be any meaningful name to user)
@USE 15.,NAME,                         (Same NAME)
@XQT FIREDATALIB*PROGRAMS.GETDATA2
  ssssssyy  ssssssyy
  etc., until all stations are listed in ascending order
@EOF

1234567890123456789012345678901234567890123456789012345678901234567890
         1         2         3         4         5         6
```

The above sequence will create a data file on logical unit 15 to be analyzed by the climatology programs. NFWL software will list the station number(s) and the number of the card images for each station. Subsequent runs of the same program, or other climatology programs within the next six days would use the following sequence to access data for analysis.

```
         1         2
12345678901234567890
@RUN
@ASG,A NAME
@USE 15.,NAME.
```

Data Format of Parameters Accessed by Climatology Programs
from the National Fire Weather Library

Record Space(s) (inclusive)	Parameter, Input format
1 - 6	Station Number (I6)
7 - 8	Year (I2)
9 - 10	Month (I2)
11 - 12	Day (I2)
14 - 16	Dry Bulb Temperature (A3)
17 - 19	Humidity Value (A3)
28 - 28	Wind Direction (I1)
29 - 31	Wind Speed (I3)
39 - 41	Period Maximum Temperature (A3)
42 - 44	Period Minimum Temperature (A3)
54 - 57	Precipitation Amount (A4)
61 - 61	Moisture Variable Index: Defines humidity variable in Columns 17 - 19. 1 = Wetbulb Temperature 2 = Relative Humidity 3 = Dew Point Temperature

Appendix B

Climatology Program ADP Worksheets

Charge Number: _____ Date: _____

User: _____

Project: _____

Notes: _____

Station Name: _____ Number: _____

Station Elevation: _____ Fire Weather Library File: _____

****

CLIMATOLOGY PROGRAM REQUEST

	SUMMARY	PRECIP1	PRECIP2	WINDS	THREEWAY
Date Begin: (YYMMDD)	_____	_____	_____	_____	_____
Date End: (YYMMDD)	_____	_____	_____	_____	_____

If SUMMARY:

	Parameter(s)	Table(s)
___	Dry Bulb Temperature	1 2 3 4 5
___	Maximum Daily Temperature	1 2 3 4 5
___	Minimum Daily Temperature	1 2 3 4 5
___	Mean Daily Temperature	1 2 3 4 5
___	Relative Humidity	1 2 3 4 5
___	Maximum Relative Humidity	1 2 3 4 5
___	Minimum Relative Humidity	1 2 3 4 5
___	Mean Relative Humidity	1 2 3 4 5

****

AVERAGING PROGRAM REQUEST

****

Program AVERAGE1

Temperature or Humidity variable to be summarized: _____

Long-term station name: _____

Short-term station name: _____

	year begin	year end	month begin	period begin*	month end	period end*
Long-term data:	_____	_____	_____	_____	_____	_____
Short-term data:	_____	_____	_____	_____	_____	_____

10-day period mean values

Short	Long
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

* periods are the 10-day period of the month

period 01 is for days 1 - 10
period 02 is for days 11 - 20
period 03 is for days 21 - 31

****

1.0 Heading: _____

2.1 First long-term station name: _____
2.2 Second long-term station name: _____
2.3 Year Begin _____ 2.4 Year End _____
2.5 Month Begin _____ 2.6 Month End _____

10-day period mean amounts (3 periods/month, enter 0 if missing)

Long Term Means (sequence 2)		Short Term Means (Sequence 3)		
Long 1	Long 2	Short	Long 1	Long 2

3.1 Short-term station name: _____
3.2 Year Begin _____ 3.3 End _____ 3.4 Month Begin _____ 3.5 End _____
4.1 Climate Station name: _____
4.2 Year Begin _____ 4.3 End _____ 4.4 Month Begin _____ 4.5 End _____

Monthly Means (sequence 4)

_____
_____
_____
_____
_____
_____

****

1.0 Heading:_____

2.1 First Long-term Station Name:_____
2.2 Second Long-term Station Name:_____

Year Begin	Year End	Month Begin	Period Begin	Month End	Period End
2.3	2.4	2.5	2.6	2.7	2.8

Mean Values (sequence 2)		Short Period Mean Values (sequence 3)		
Long 1	Long 2	Short 1	Short 2	Short 3

3.1 First Long Station Name (short record period):_____
3.2 Second Long Station Name (short record period):_____
3.3 Primary Short-term Station Name:_____

Short Period Data Sepcifications

Year Begin	Year End	Month Begin	Period Begin	Month End	Period End
3.4	3.5	3.6	3.7	3.8	3.9